

Importance of physical property evaluation for methane hydrate R&D and pressure coring-analysis operation

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In the cases of either natural phenomenon or an artificial operation for resource development, a gas hydrate dissociation process can be regarded as transportation of heat and fluid masses in porous media. Because the convection term is dominant, the heat transport is highly affected by the fluid flow. The reasons why those basic physical problems are complicated are intrinsic complexity of geological formations, alternation of the physical parameters due to hydrate dissociation, and mechanical behaviors of soft sediments that can transform the properties dynamically. Therefore the focus of studies on the energy production technique from gas hydrate deposits is to understand the hydraulic, thermal, and mechanical properties and processes.

In the study program of the MH21 research consortium, evaluation of such physical properties, their distribution in geological formations, and dynamic behavior of them have been investigated through seismic surveys, drilling operations including geophysical logging, sampling and in-situ testing, laboratory experiments, numerical simulation, and so on. As one of those efforts, pressure core sampling in which the in-situ condition is kept, and measurement of the properties of the retrieved sample are especially important.

In June and July of 2012, the MH21 consortium has conducted core sampling operation in Daini Atsumi Knoll of the eastern Nankai Trough using a pressure coring device and D/V Chikyu (JAMSTEC). In the operation, about 35m samples were recovered by the device, and majority of them were fully or partially pressure-preserved.

After the on-board analyses, some of those retrieved samples were delivered to onshore laboratory testings under more controlled conditions. The main purpose of the study is to measure hydraulic and mechanical properties. Also relationship of the properties and geological features are important, and analyses on them could drive important knowledge about the sedimentation conditions of them.

A part of the study was conducted under Japan-US collaboration. The results are publicized in a special issue of Journal of Marine and Petroleum Geology. In this presentation, objectives, core sampling operation, and analysis flow are presented.

Keywords: methane hydrate, pressure core, hydraulic, mechanics, physical properties